CLAIMS

What is claimed is:

1. A method for operating a wireless communications system, comprising:

transmitting a waveform, the waveform comprising a plurality of repeating frames each comprising x header training base symbols in a header training symbol field (TH) and y tail training base symbols in a tail training symbol field (TT); and

receiving a frame; where

the received frame functions as one of a plurality of different types of frames depending on the content of at least TT.

2. A method as in claim 1, wherein a frame functions as one of a normal traffic frame, a termination frame, or a legacy frame providing backwards compatibility with another waveform.

3. A method as in claim 1, wherein x=2 and y=3.

4. A method as in claim 1, wherein the frame comprises four equal-size data fields separated by three equal-sized control fields, the header training symbol field (TH) and the tail training symbol field (TT).

5. A method as in claim 4, wherein a percentage of the total frame occupied by each of the data, control, TH and TT fields remains constant for each symbol rate supported by the waveform, and where the TH and TT base symbol sequences are repeated at higher symbol rates.

6. A method as in claim 1, wherein for the normal frame the content of both the header and tail training symbol fields is the same for each frame and are not error correction encoded, and wherein the TH and TT are used by receiver circuitry at least for one of frame synchronization, equalizer training and AGC training purposes.

7. A method as in claim 6, wherein for the termination frame TH is the same as in the normal frame, and wherein at least a portion of the TT is generated by a channel coder, the size of the portion being determined by the symbol rate.

8. A method as in claim 7, wherein at symbol rates of 21.25 ksps and 42.5 ksps the entire TH is generated by the channel coder, and at symbol rates greater than 42.25 ksps only the beginning symbols of the of the TH are generated by the channel coder, and the remaining symbols are the same as for the normal frame format.

9. A method as in claim 8, wherein state of the beginning symbols of the TT is determined by the final state of the channel coder.

10. A method as in claim 2, wherein in the legacy frame format an initial symbol training header field is referred to as a SYNC END (SE) field, a terminal symbol training tail field is referred to as a SYNC START (SS) field, and to achieve backwards compatibility SE = [1+j, -1-j, -1+j] and SS = [1+j, 1-j], where 4-QAM symbols are of the form s = I + j Q.

11. A method as in claim 10, wherein three consecutive legacy frames form a superframe that is delimited by inverting the SS and SE fields, and wherein the TH and TT fields are inverted every third frame to delimit a legacy superframe.

12. A method as in claim 1, wherein the waveform uses multi-carrier transmission, and supports up to four carriers with aggregation between carriers such that a given user's data can be conveyed simultaneously by more than one carrier.

13. A method as in claim 1, wherein the waveform is a DS-CDMA waveform that uses a fixed chip rate of 2.72 Mcps and variable-length, orthogonal spreading codes constructed from randomized Walsh-Hadamard designs using spread factors of 1, 2, 4, 8, 16, 32, 64, 128, and greater, chips/symbol.

14. A method as in claim 1, wherein the waveform supports 4-QAM and 16-QAM modulation formats with convolutional coding.

15. A method as in claim 2, wherein the waveform supports a 4-QAM modulation format when operating in the legacy mode.

16. A method as in claim 1, wherein the waveform is a DS-CDMA waveform that supports payload data rates of 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, and greater, kbps per CDMA channel.

17. A method as in claim 1, wherein the waveform is a DS-CDMA waveform that supports aggregation of CDMA channels to support payload data rates of the form

n x 32 kbps up to 32.768 Mbps in both forward and reverse links.

18. A method as in claim 1, wherein the waveform is a DS-CDMA waveform that supports 4-QAM and 16-QAM with rate 4/5 convolutional coding.

19. A method as in claim 18, wherein the transmitted energy per 4-QAM symbol, assuming equal-probability input bits, is $E_s = 2A^2/T_s$, where T_s is the symbol duration in seconds, where A is a constellation spacing factor.

20. A method as in claim 18, wherein the transmitted energy per 16-QAM symbol, assuming equal-probability input bits is $E_s = 10A^2/T_s$, where T_s is the symbol duration in seconds, where A is a constellation spacing factor.

21. A method as in claim 18, wherein when using rate 4/5 error control coding, the waveform spectral efficiency, measured as information bits per coded symbol, for 4-QAM is 1.6 bits/symbol, and the waveform spectral efficiency for 16-QAM is 3.2 bits/symbol.

22. A method as in claim 18, wherein both the 4-QAM and 16-QAM operate with symbol rates of 21.25, 42.5, 85, 170 and 2720 ksps on each of a plurality of CDMA channels.

23. A method as in claim 18, and further comprising equalizing energy to equalize performance, measured in terms of at least bit error rate (BER) or signal-to-noise ratio (SNR), over all modulation formats and all symbol rates by using an appropriate constellation spacing parameter (A).

24. A method as in claim 23, wherein the step of equalizing operates so as to transmit equal energy per symbol.

25. A method as in claim 23, wherein the step of equalizing operates so as to transmit equal energy per bit.

26. A method as in claim 1, wherein the step of receiving includes a step identifying the frame as to a type of frame by examining at least the content of TT.

27. A DS-CDMA communications system, comprising a node for transmitting a CDMA waveform, the CDMA waveform comprising a plurality of repeating frames each comprising x header training base symbols in a header training symbol field

(TH) and y tail training base symbols in a tail training symbol field (TT); and a node for receiving the CDMA waveform, where a received frame is one of a plurality of different types of frames depending on the content of at least TT.

28. A method as in claim 27, wherein a frame is one of a normal traffic frame, a termination frame, or a legacy frame providing backwards compatibility with another waveform.

29. A method for operating a CDMA communications system, comprising:

transmitting traffic frames over a CDMA channel, each traffic frame containing coded data and comprising x header training base symbols in a header training symbol field (TH) and y tail training base symbols in a tail training symbol field (TT), the TH and TT field each containing fixed training data for use by a receiver;

when transmitting a last traffic frame over the CDMA channel, replacing at least a part of the fixed training data in the TT field with data generated by a data encoder; and

receiving the last traffic frame and using, for a data decoder, data from the TT field that was generated by the data encoder.

30. A method as in claim 29, wherein the data encoder is a fractional rate data encoder.